

ROTOPTER

A new type of winged aircraft

Wrote for the Helicopter History Site by **Dr. Vladimir Savov**

A new type of winged aircraft was proposed recently by **Dr. Vladimir Savov** from Bulgarian Air Force Academy. The new type of aircraft was derived from a classification of the winged aircraft by the type of wing movements in horizontal and vertical plane.

Wing movement		In horizontal plane	
		translational	rotational
In vertical plane	no movement	airplane	helicopter
	reciprocal	ornithopter	?

The new rotorcraft concept was named rotopter (from 'rotor' and 'ornithopter'). The essence of the rotopter concept is to substitute progressive motion of the flapping wing with rotation: flap ergo turn ([fig.1](#)). But maybe the real significance of the rotopter concept is that it allows welldeveloped helicopter rotor technology to be applied to the flapping flight. That's why the rotopter rotor to great extent looks like a helicopter rotor ([fig.2](#)).

The rotopter operates as follows. The crank mechanism drives the slider into reciprocal motion, which is being converted by the link mechanism into flapping of the blades. The mass characteristics of the blade and rigidity of the elastic element are selected so as to ensure changing of the blade angle of incidence lagging by 90o from the angle of flapping. The flapping blade of the rotopter creates thrust and lift similarly to the flapping wing of a bird or an insect. Due to the thrust the blade begins to rotate. Magnitude and direction of the lift force is controlled via the swash plate mechanism analogously to the way it is carried out on the helicopter rotor. When in progressive flight, velocity head on the advanced blade is greater than the head on the retreating one, respectively the lift on the advanced blade is greater than on the retreating. Increased lift creates greater nose-down moment around the axial hinge, the angle of incidence decreases, so does the lift and the banking moment is being reduced.

It is expected that the rotopter has some advantages in comparison with the helicopter rotor:

- there is no torque reaction;
- the induced power losses are possibly lower due to the unsteady flow.;

The rotopter has certain advantages in comparison with the ornithopter:

- velocity triangles in different crosssections along the rotopter blade are geometrically similar, hence no twisting is necessary;

- the forward speed of the blade is not directly connected with the speed of the aircraft, hence vertical flight or maintaining optimal speed of rotation when in level flight is possible;
- the centrifugal force reduces compressive stress on the upper surface of the blade.

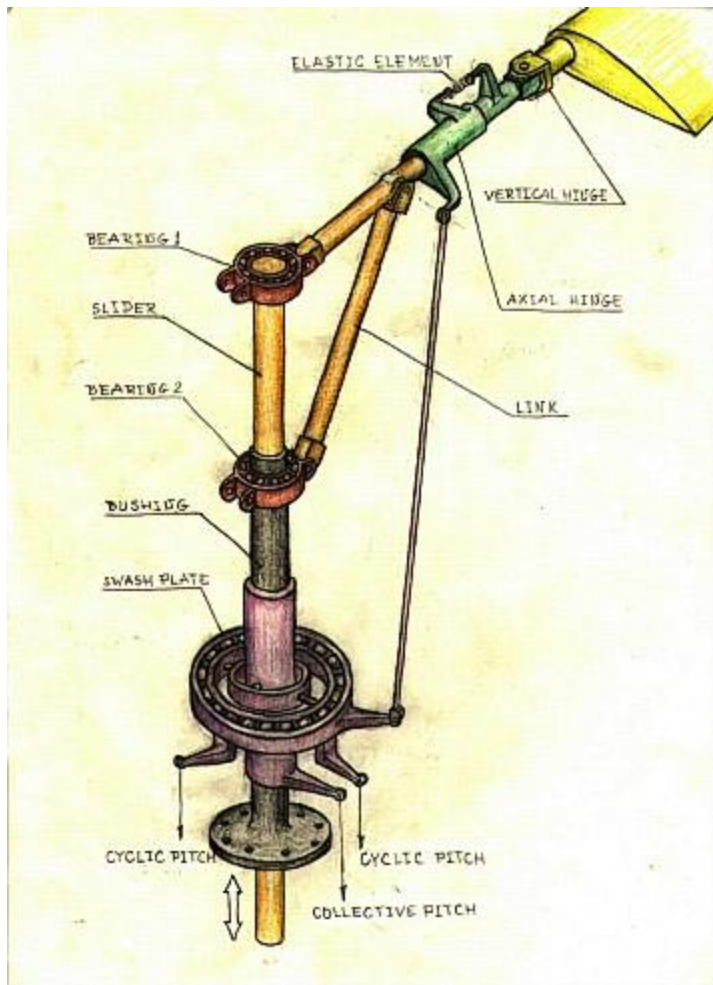
The unfavorable load distribution along the blade, the cyclic variation of the lift and increased due to the centrifugal forces bending moment at the root of the blade probably confine the use of the rotopter concept for small aircraft only (micro air vehicles).

At the current moment the development of the rotopter concept is in the following state:

- mathematical model of the rotopter aerodynamics based on the element-impulse theory has been created and used for optimizing rotopter kinematics.
- laboratory model was built, allowing measuring of the lift and consumed power (fig.3). The experiments with the laboratory model demonstrated that the concept of the rotopter works i.e. the blades rotate and create lift force. It was also ascertained that the efficiency of the rotopter is ultimately sensitive to the law of variation of the blade angle of incidence. At the current stage, achieved coefficient of efficiency of the rotopter is considerably less than the usual for a conventional helicopter rotor. There is hope that if more sophisticated numerical model of the flow around rotopter blade is developed and the motion of the blade is optimized, the efficiency coefficient of the rotopter will exceed the one of a conventional rotor.
- a small (20 cm) flying model is under construction.

It is early to predict what the rotopter could be used for besides completing the list of the winged aircraft. Let's hope that the fresh main idea and existing rotor technology will ensure fast developing of the new hatched out rotopteryx.

Visit the ROTOPTER 's [web site](#)





Radio controlled, US Patent Pending HoverCopter Prototype made from carbon fiber, foam and epoxy. Weighs about 200 lbs.



**Our 1st prototype BodyCopter
(Backpack VTOL copter)**



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(Prototype has 1)**

Introducing the, fly from home, Volkswagon of personal, commuter, local and sport flying.

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Are you tired of waiting for those affordable, safe, practical, flying cars we were promised back in the 1950s and 60s? Want to fly from, and land in, your driveway?

Me, too! So, What's the holdup?

THE CRASH, SAFETY (NON) ISSUE:

On the surface, the possibility of a crash seems to be a major issue. But, our vision is for these crafts to fly at a MAXIMUM of 100 to 300 feet above the ground (just above treetop level in free air space) at 50 to 100 mph.

FAIL-SAFE, EMERGENCY POWER

At that height, the craft would need about a minute of emergency power to land safely. An 8 pound, gear driven automobile starter motor mounted below the fans driveshaft can provide one to five minutes of emergency power using the same battery the main engine uses to start. This emergency power on every craft will automatically engage in case of any trouble and lower the craft gently to the ground or water.

Every HoverCopter will have a floatation ring around the bottom. The design allows for maneuvering on, and hovering over water. Stop on the way home and get some fishing done. Take the kids swimming with the craft acts as your personal/family watercraft.

SO, THE CRASH, SAFETY ISSUE IS REALLY A NON-ISSUE.

THE YOU CAN'T FLY THERE (NON) ISSUE

The issue of flying into prisons, over military installations, into nuclear power stations, into an office building etc. can be addressed at the factory, pre-programming the GPS guidance around such things.

SO, THE YOU CAN'T FLY THERE ISSUE IS REALLY A NON-ISSUE.

LICENSE TO FLY

Did you know a license (of any kind) is unnecessary to fly an ultralight aircraft? Its true! We have two concept crafts in the ultralight craft category.

LIGHTWEIGHT POWER

Engines are lighter and more powerful, NOW!

There's a motor at www.rotoblock.com with twice the horsepower for the same weight. The son of the late Harold McMaster, an internationally known inventor and business person is continuing his father's work on an engine weighing 40 to 50 pounds producing 200 horsepower with only two moving parts. Check it out www.mcmastermotor.com/concept.htm

LIGHTWEIGHT CONSTRUCTION

Composite building materials are cheaper, lighter and stronger, NOW!

VERTICAL TAKE-OFF AND LANDING (VTOL)

What a concept! VTOL means you can roll or hover out of your carport or vented garage and rise straight up above the trees, and land just as easily.

GUIDANCE

GLOBAL POSITIONING SATELLITE - GPS

Another NOW technology that makes personal and family flying not only possible but practical. With GPS you simply key in your position and your destination, a map appears, and your craft takes you there as you (and your family) enjoy the view. You have broken free from traffic, you've seen the sights, you've saved time and you've been SAFER than if you were in the family automobile.

TORQUE STABILIZED VERTICAL LIFTING SYSTEM

The Torque Stabilized Vertical Lifting System is the last piece of the puzzle necessary for every driveway in the world to become a VTOL airport. Personal and family flying as the preferred way to travel can now become a reality.

The Torque Stabilized, Vertical, Lifting System does away with the exposed main rotor and completely does away with the tail rotor of a helicopter type lifting system by using the down draft created by spinning a horizontal rotor blade to achieve reverse torque and rotational control.

TECHNOLOGY

The technology is simple and it is here NOW. VTOL flying cars, backpack flying, and two seat ultralight flying can be here today, safely, affordably, simply... It is not a dream anymore. It is a practical goal.

BodyCopter & HoverCopter Charles Medlock

The BodyCopter is the aircraft you will be able to store in your closet, fly to work, put in your trunk, and take off and land in any 15' open space.

The BodyCopter, designed by Charles Medlock, is unique in several ways, but the most interesting is the use of vertical airfoils to control the reverse torque created by spinning the horizontal rotor blades.

The BodyCopter uses the down draft created by the horizontal rotor to achieve reverse torque and rotational control. Basically, free floating variable and fixed vertical airfoils create "horizontal lift" in the same direction but on

opposite sides of the axis of the horizontal rotor. By changing the angle of attack of the vertical airfoils while maintaining balanced "horizontal lift", rotational control is achieved thus eliminating the need for a tail rotor blade.

Used a 20 hp engine to turn a 10 foot blade at around 900 rpms and looking for total lift of about 400 pounds. The horizontal lift, vertical airfoils are fixed and variable pitch and are free floating so they balance any angle of attack. The unit currently weighs around 120 pounds but the production model will have two engines for safety sake and weigh only about 60 pounds. There are also plans for a folding unit with three blades. It will stand on its own on the three blades and conceivably, you could store it in the space of a closet.





On August 2004, the **HoverCopter** prototype lift off.



More info at <http://www.hovercopter.us>